

NEW SPECIES OF *CLOEON* AND *DEMOULINIA* (EPHEMEROPTERA: BAETIDAE) FROM MADAGASCAR^{1,2}

C. R. Lugo-Ortiz, W. P. McCafferty³

ABSTRACT: *Cloeon emmanueli*, new species, and *Demoulinia insularis*, new species, are described from larvae from Madagascar. *Cloeon emmanueli* represents the first *bona fide* report of *Cloeon* from the island. The species is distinguished by the setation of the labrum, abdominal color pattern, tergal armature, and irregular paraproctal spines. *Cloeon cambouei*, *C. durani*, and *C. irretitum* are considered *nomina dubia* because they were described from subimagos only. *Demoulinia insularis* is the first species of *Demoulinia* to be reported from the island. The species is distinguished by the relatively wide anteromedial emargination of the labrum, edentate tarsal claws, and numerous paraproctal spines.

The faunal composition of the small minnow mayflies (Ephemeroptera: Baetidae) of Madagascar has recently received considerable attention (Lugo-Ortiz and McCafferty 1997abef, 1998a), but requires additional study. Baetid genera that were shown in those works to occur in Madagascar include *Afroptilum* Gillies, *Cheleocloeon* Wuillot and Gillies, *Dabulamanzia* Lugo-Ortiz and McCafferty, *Dicentropilum* Wuillot and Gillies, *Edmulmeatus* Lugo-Ortiz and McCafferty, *Herbrossus* McCafferty and Lugo-Ortiz, *Labiobaetis* Novikova and Kluge, *Mutelocloeon* Gillies and Elouard, and *Xyrodromeus* Lugo-Ortiz and McCafferty. Lugo-Ortiz and McCafferty (1998a) confirmed that *Nesoptiloides*, first described from Madagascar by Demoulin (1973), was a valid genus. Reports of adults of *Centropilum* Eaton from Madagascar are, however, highly tenuous because species previously assigned to that genus in Africa have been shown to represent diverse evolutionary lineages not including *Centropilum* (Gillies 1990, Wuillot and Gillies 1994, Lugo-Ortiz and McCafferty 1996abc, 1997cd, 1998ab, McCafferty et al. 1997). We expect such adults in Madagascar to be members of the *Centropiloides* complex (see Lugo-Ortiz and McCafferty 1998a). Madagascar species described as *Cloeon* Leach are based on subimagos (Navás 1926, 1930, 1936) that cannot be placed to genus with any reliability.

In this paper, we describe one species of *Cloeon* and one species of *Demoulinia* Gillies based on larvae collected from Madagascar. The new species of *Cloeon* represents the first substantiated report of the genus from Madagascar, and the new species of *Demoulinia* is the first of that genus to be described from the island. Examined specimens are housed in the Purdue Entomological Research Collection, West Lafayette, Indiana.

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³ Department of Entomology, Purdue University, West Lafayette, IN 47907.

Cloeon emmanueli Lugo-Ortiz and McCafferty, NEW SPECIES

Larva. Body length: 4.3-5.2 mm. Caudal filaments length: 3.0-4.7 mm. Head: Coloration medium brown to medium yellow-brown, with no distinct markings. Antennae approximately 3.0x length of head capsule. Labrum (Fig. 1) with numerous long, fine, simple setae scattered over surface. Hypopharynx as in Figure 2. Left mandible (Fig. 3) with seven denticles; prostheca apically denticulate; tuft of long, fine, simple setae between prostheca and mola. Right mandible (Fig. 4) with outer set of incisors with four denticles and inner set with two denticles; tuft of long, fine, simple setae between prostheca and mola. Maxillae (Fig. 5) with irregular row of long, fine, simple setae submedially in midregion; palps three segmented; palp segment 1 approximately 0.63x length of segment 2 and 3 combined; segment 2 approximately 1.45x length of segment 3; segment 3 poorly defined. Labium (Fig. 6) with glossae slightly longer than paraglossae; glossae basally broad, apically narrow, with minute, fine, simple setae ventrally near base; paraglossae broadly rounded apically, with three rows of long, fine, simple setae ventrally and few minute, fine, simple setae scattered dorsally near base; palp segment 1 approximately 0.82x length of segments 2 and 3 combined; segment 2 subequal in length to segment 3, with row of five to six minute, fine, simple setae dorsally; segment 3 with numerous long, somewhat robust, simple setae scattered over surface. Thorax: Coloration medium yellow-brown, with no distinct markings. Hindwingpads absent. Legs (Fig. 7) pale yellow-brown; femora with two rows of 10-12 robust, apically pointed setae dorsally and numerous short, stout, simple seta ventrally; tibiae with few long, fine, simple setae and one long, robust, simple setae dorsally near apex, and two rows of 15-17 robust, apically pointed, simple setae ventrally; tarsi with few, long, fine, simple setae dorsally and two rows of robust, apically pointed, simple and pectinate setae ventrally; tarsal claws (Fig. 8) with two rows of 15-20 minute to small denticles each. Abdomen: Coloration medium yellow-brown and medium brown; segments 1 and 10 medium yellow-brown; segments 2 and 3 medium yellow-brown, medium brown sublaterally; segments 4-9 medium yellow-brown, with small medium brown markings anterolaterally. Sterna medium yellow-brown; sterna 4-9 with faint medium brown broad band medially. Terga (Fig. 9) with numerous scale bases and few minute, fine, simple setae scattered over surface; posterior triangular spination irregular. Gills 1-6 with two lamellae, gill 7 single. Paraproct (Fig. 10) with 10-12 marginal spines and numerous minute, fine, simple setae scattered over surface. Caudal filaments pale yellow-brown, with medium brown annulations every three to four segments; terminal filament approximately 0.60x length of cerci.

Adult. Unknown.

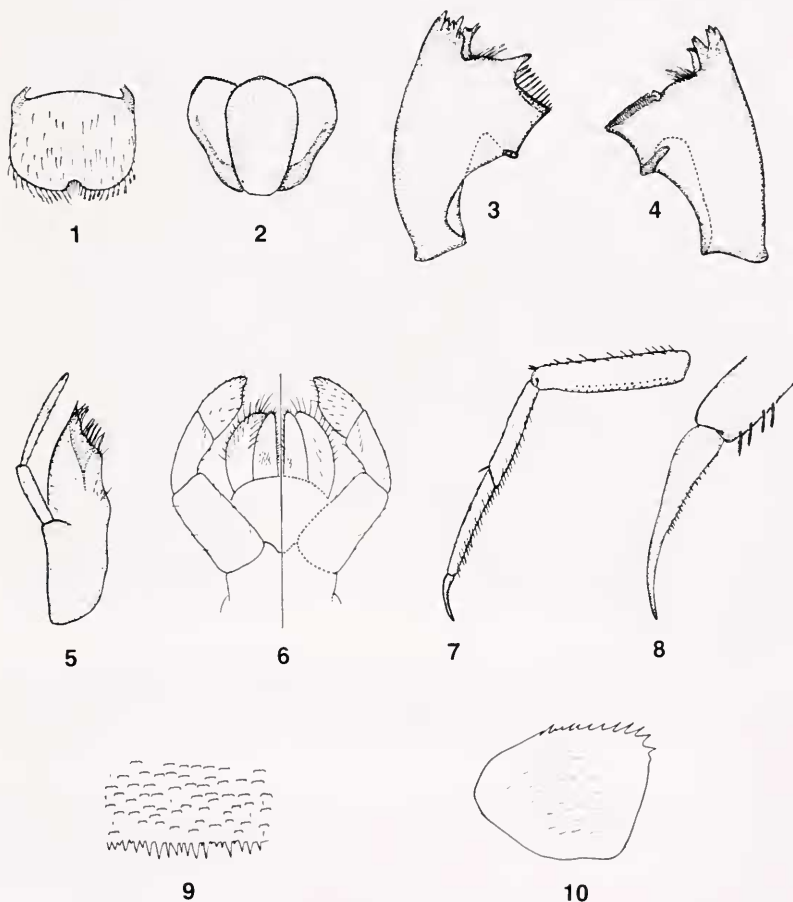
Material examined. Holotype: Larva, MADAGASCAR, Antsiranana Prov., Djabala R., 11 km NW of Hell-Ville, Nosy Be, 25-X-1971, G. F., C. H. Edmunds, and F. Emmanuel. Paratype: Larva, same data as holotype [mouthparts, left foreleg, tergum 4, gills 4, and paraproct of one larva mounted on slide (medium: Euparal)]. Additional material: Four larvae, same data as holotype.

Etymology. We name this species after F. Emmanuel (Madagascar), who assisted in its collection.

Discussion. Although no other species of *Cloeon* from Madagascar are known from the larval stage, we expect that the setation of the labrum (Fig. 1), abdominal color pattern, tergal armature (Fig. 9), and paraproctal spination (Fig. 10) will be diagnostic features of *C. emmanueli*.

The genus *Cloeon* has been reported from much of the world, although

reports of its presence in South America are considered incorrect (McCafferty 1998), and it is only adventive in North America (McCafferty 1996). Its presence in southern Africa and the Orient suggested that it could be present in Madagascar. However, species previously assigned to *Cloeon* in Madagascar include only the highly dubious *C. durani* Navás (1926), *C. cambouei* Navás (1930), and *C. irretitum* Navás (1936). *Cloeon durani* and *C. cambouei* were originally described from female subimagos, and *C. irretitum* was originally



Figs. 1-10. *Cloeon emmanueli*, larva. 1. Labrum (dorsal). 2. Hypopharynx. 3. Left mandible. 4. Right mandible. 5. Right maxilla. 6. Labium (right-ventral; left-dorsal). 7. Right foreleg. 8. Tarsal claw. 9. Tergum 4 (detail). 10. Paraproct.

described from male and female subimagos. Because the three species are so poorly known and because their taxonomic status cannot be corroborated, we place the three names as *nomina dubia*. Thus, *C. emmanueli* is the only *bona fide* species of *Cloeon* known from Madagascar at this time.

Demoulinia insularis Lugo-Ortiz and McCafferty, NEW SPECIES

Larva. Body length: 7.3 mm. Caudal filaments length: 3.5 mm. Head: Coloration medium yellow-brown, with no distinct pattern. Antennal length unknown. Labrum (Fig. 11) with numerous long, fine, simple setae scattered over surface. Hypopharynx as in Figure 12. Left mandible (Fig. 13) with outer set of incisors with three denticles and inner set with two denticles. Right mandible (Fig. 14) with outer set of incisors with three denticles and inner set with two denticles. Maxillae (Fig. 15) with row of 10-12 long, fine, simple setae near crown of galealaciniae and row of six to seven long, fine, simple setae submedially in midregion; palps two segmented; palp segment 1 approximately 0.70x length of segment 2. Labium (Fig. 16) with glossae subequal in length to paraglossae; glossae broadly rounded apically, with minute, stout, simple setae dorsally; paraglossae acute apically, with numerous long, fine, simple setae ventrally and three rows of long, fine, simple setae dorsally; palp segment 1 approximately 0.80x length of segments 2 and 3 combined, with numerous long, fine, simple setae basomedially; segment 2 approximately 2.25x length of segment 3, with numerous long, robust, simple setae on distomedial process; segment 3 slender and elongate, with numerous long, robust, simple setae scattered over surface. Thorax: Coloration medium yellow-brown, with no distinct markings. Hindwingpads absent. Legs (Fig. 17) pale yellow-brown; femora with numerous minute, fine, simple setae and minute, stout, simple setae dorsally and ventrally, setae more abundant ventrally; tibiae and tarsi with numerous minute, fine, simple setae dorsally and numerous minute, stout, simple setae ventrally; tarsal claws approximately 0.63x length of tarsi, edentate. Abdomen: Coloration medium brown to yellow-brown; tergum 1 medium brown, with no markings; tergum 2 medium brown, with anteromedial pair of round, medium brown spots; terga 3-9 medium brown anteriorly, yellow-brown posteriorly, with anteromedial pair of medium brown dashes; terga 7-9 with submedial pair of round, medium brown spots in midregion; tergum 10 yellow-brown. Sterna pale yellow brown, with no distinct pattern. Terga (Fig. 18) with numerous scale bases; posterior triangular spines approximately 1.2x basal width. Gills subtriangular, poorly tracheated, marginally smooth. Paraproct (Fig. 19) with numerous marginal spines, increasing in size apically. Caudal filaments pale yellow-brown; terminal filament subequal in length to cerci.

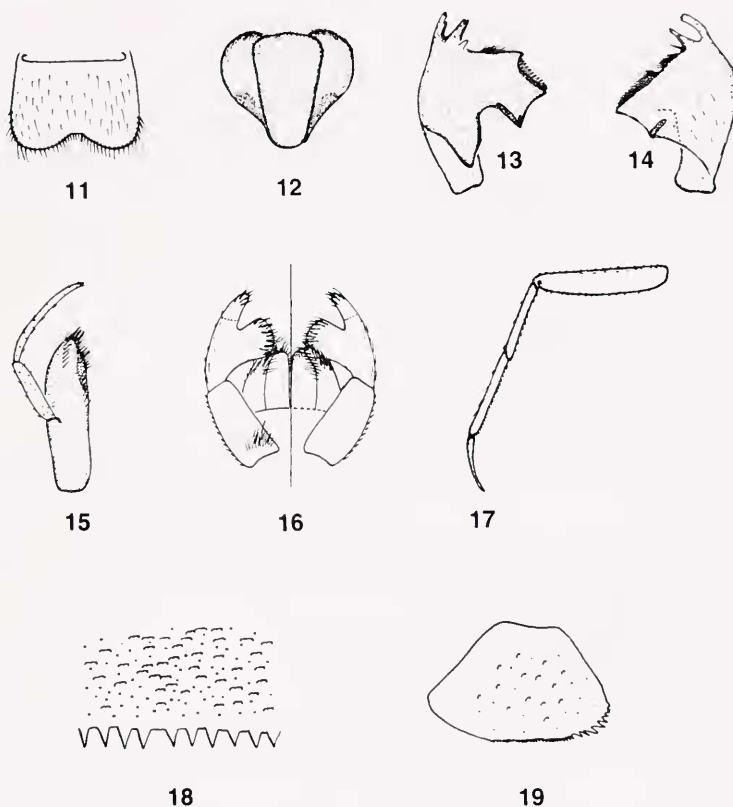
Adult. Unknown.

Material examined. Holotype: Larva, MADAGASCAR, Antananarivo (= Tananarive) Prov., Ankeniheny R., 28°C, 4 km S of Manjakatempo Forest Station, 1-XI-1971, G.F., C. H. Edmunds, and F. Emmanuel [mouthparts, forelegs, tergum 4, and paraproct on slide (medium: Euparal)].

Etymology. The specific epithet is a Latin word meaning "from an island."

Discussion. *Demoulinia* has been known previously only from South Africa (Demoulin 1970, Gillies 1990). *Demoulinia insularis* is distinguished from the southern African species *D. crassi* (Demoulin) by the relatively wide anteromedial emargination of the labrum (Fig. 11), edentate tarsal claws (Fig. 17), and numerous small spines of the paraproct (Fig. 19).

The presence of *D. insularis* in Madagascar is significant because it indicates that *Demoulinia* was well established in at least West Gondwanaland before the island began to separate from the African landmass approximately 100 million years ago.



Figs. 11-19. *Demoulinia insularis*, larva. 11. Labrum (dorsal). 12. Hypopharynx. 13. Left mandible. 14. Right mandible. 15. Right maxilla. 16. Labium (left-ventral; right-dorsal). 17. Right foreleg. 18. Tergum 4 (detail). 19. Paraproct.

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